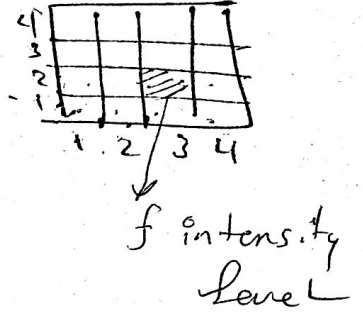


(1)

3 Sampling & Quantization

$$f(x, y) = \text{Image}$$

Sampling : the process of digitizing the ^{into} spatial coordinates (x, y)



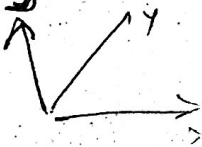
Quantization : the process of digitizing the amplitude (Intensity Level) values.

0 1 2 3 4 ... 255

Image Representation

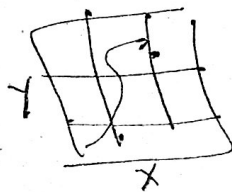
- Surface (3-D image)

Image where two dimension represent spatial coordinates (x, y) and the third dimension is the Intensity Level.



- Image for human

2-D image

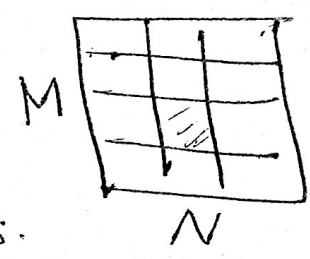


Used by human to see objects.

- Array images

the image is represented as matrix of f values (used in algorithms)

• k-bit image
 bit k is no. of pixels



$L = 2^k$: no. of intensity levels;
 e.g. 8-bit $\Rightarrow 256$ levels

$$\text{Dynamic Range} = \frac{\text{Max intensity level}}{\text{Min intensity level}}$$

$$\text{Contrast} = \text{Max intensity level} - \text{Min intensity level}$$

Well known

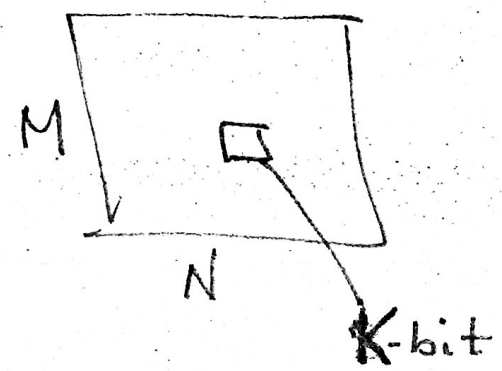
max intensity is controlled by saturation
 Min intensity level is controlled by noise

Image Storage

$b = M \times N \times k$

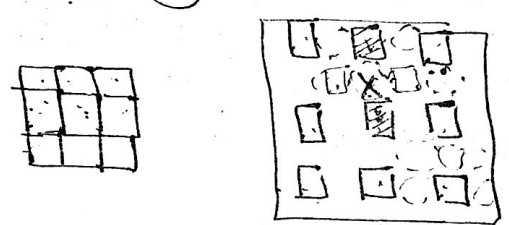
\downarrow
 Storage of image by bits

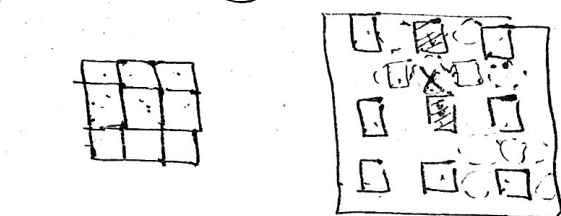
\swarrow
 no. of bits for each pixel



spatial resolution no. of pixels per unit distance. (DPI) [3]
Intensity resolution: no. of bits used to quantize Intensity.
no. intensity = 2^k

Interpolation: is the process of using known data to estimate values of unknown location

Resizing 



Types of interpolation:

① nearest neighbor interpolation

it assigns to each new location the intensity of its nearest neighbor in the original image.

Produce Bad results (Pixelated images)

② bilinear

Use the 4 nearest neighbors to estimate the intensity at a given location

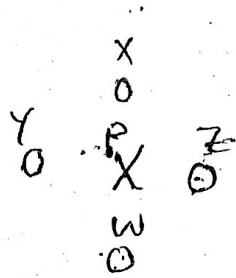
give better results

③ bicubic which involves the 16 nearest neighbor of a point.

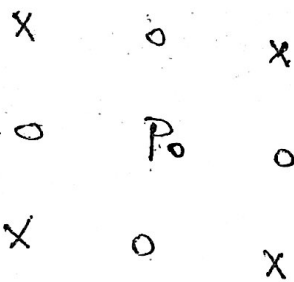
Best results

neighborhood & adjacency

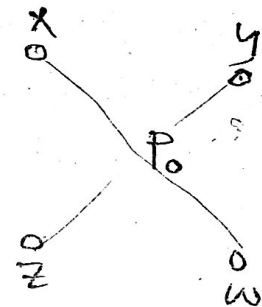
[4]



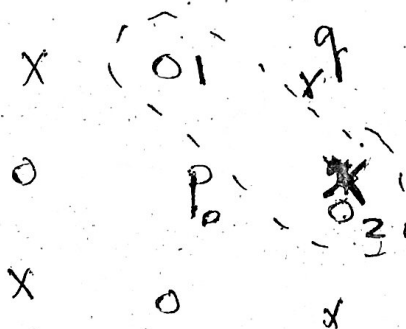
الجوار الرابع = $N_4(P) = \{x, y, z, w\}$



الجوار الثماني $N_8(P) = N_4(P) \cup N_D(P)$



الجوار القطري $N_D(P) = \{x, y, z, w\}$
Diagonal
قطر



$V = \{5, 6, 10\}$
↓
List of intensity

$N_m(P) \Rightarrow N_4(P) \Rightarrow x \in V_m(P)$
or $N_D(P)$ iff $N_4(P) \cap N_4(q) = \emptyset$

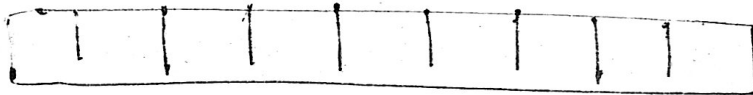
Sensors to Capture Image

1) Single Sensor



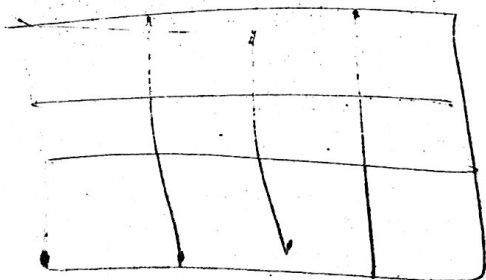
both x & y dimension are controlled by Mechanical movement.

2) Sensor Strip



- one dimension is controlled by mechanical movement
- the other direction is controlled by the no. of sensors on the strip.

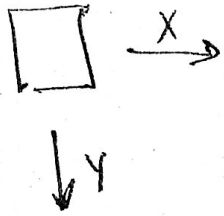
3) Sensor Array



- no mechanical movement

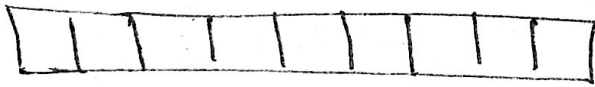
Image Acquisition

1] Single Sensor



both x & y dimension is controlled by mechanical movement.

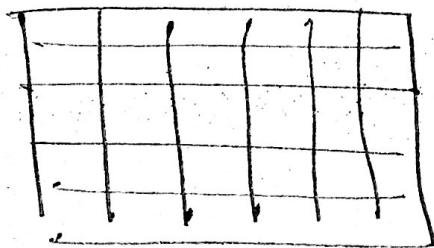
2] Sensor Strip



- one dimension is controlled by the number of sensors

- and the other dimension is controlled by mechanical movement.

3] Array Sensor



- No mechanical movement

- two dimensions of image are controlled by number of pixels in the 2D array.